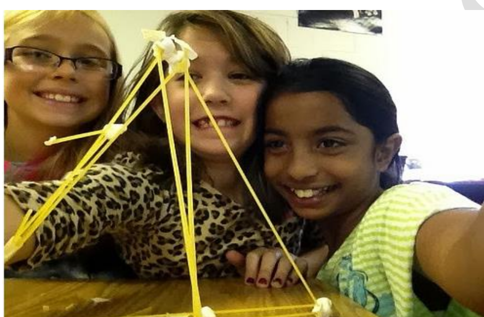
SUPPORT GUIDE FOR GRADE THREE SOUTH CAROLINA ACADEMIC STANDARDS AND PERFORMANCE INDICATORS FOR SCIENCE


Molly M. Spearman
State Superintendent of Education

SOUTH CAROLINA
STATE DEPARTMENT
OF EDUCATION



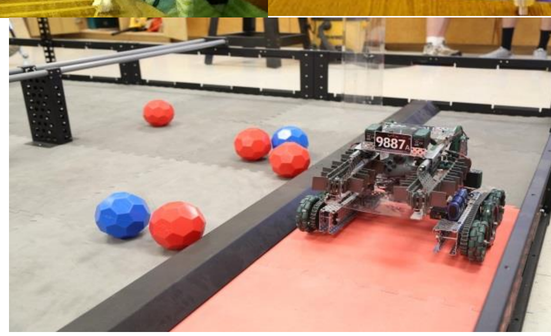


Table of Contents

Standards

Crosswalk

Content Support Guide

INTRODUCTION TO GRADE THREE STANDARDS

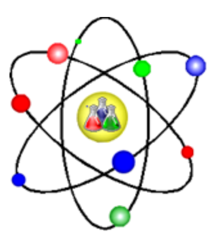
Science is a way of understanding the physical universe using observation and experimentation to explain natural phenomena. Science also refers to an organized body of knowledge that includes core ideas to the disciplines and common themes that bridge the disciplines. This document, *South Carolina Academic Standards and Performance Indicators for Science,* contains the academic standards in science for the state's students in kindergarten through grade twelve.

ACADEMIC STANDARDS

In accordance with the South Carolina Education Accountability Act of 1998 (S.C. Code Ann. § 59-18-110), the purpose of academic standards is to provide the basis for the development of local curricula and statewide assessment. Consensually developed academic standards describe for each grade and high school core area the specific areas of student learning that are considered the most important for proficiency in the discipline at the particular level.

Operating procedures for the review and revision of all South Carolina academic standards were jointly developed by staff at the State Department of Education (SCDE) and the Education Oversight Committee (EOC). According to these procedures, a field review of the first draft of the revised South Carolina science standards was conducted from March through May 2013. Feedback from that review and input from the SCDE and EOC review panels was considered and used to develop these standards.

The academic standards in this document are not sequenced for instruction and do not prescribe classroom activities; materials; or instructional strategies, approaches, or practices. The *South Carolina Academic Standards and Performance Indicators for Science* is not a curriculum.



THE PROFILE OF THE SOUTH CAROLINA GRADUATE

The *2014 South Carolina Academic Standards and Performance Indicators for Science* support the *Profile of the South Carolina Graduate. The Profile of the South Carolina Graduate* has been adopted and approved by the South Carolina Association of School Administrators (SCASA), the South Carolina Chamber of Commerce, the South Carolina Council on Competitiveness, the Education Oversight Committee (EOC), the State Board of Education (SBE), and the South Carolina Department of Education (SCDE) in an effort to identify the knowledge, skills, and characteristics a high school graduate should possess in order to be prepared for success as they enter college or pursue a career. The profile is intended to guide all that is done in support of college- and career-readiness.

Profile of the South Carolina Graduate

World Class Knowledge

- Rigorous standards in language arts and math for career and college readiness
- Multiple languages, science, technology, engineering, mathematics (STEM), arts and social sciences

World Class Skills

- Creativity and innovation
- Critical thinking and problem solving
- Collaboration and teamwork
- Communication, information, media and technology
- Knowing how to learn

Life and Career Characteristics

- Integrity
- Self-direction
- Global perspective
- Perseverance
- Work ethic
- Interpersonal skills

Approved by SCASA Superintendent's Roundtable and SC Chamber of Commerce.

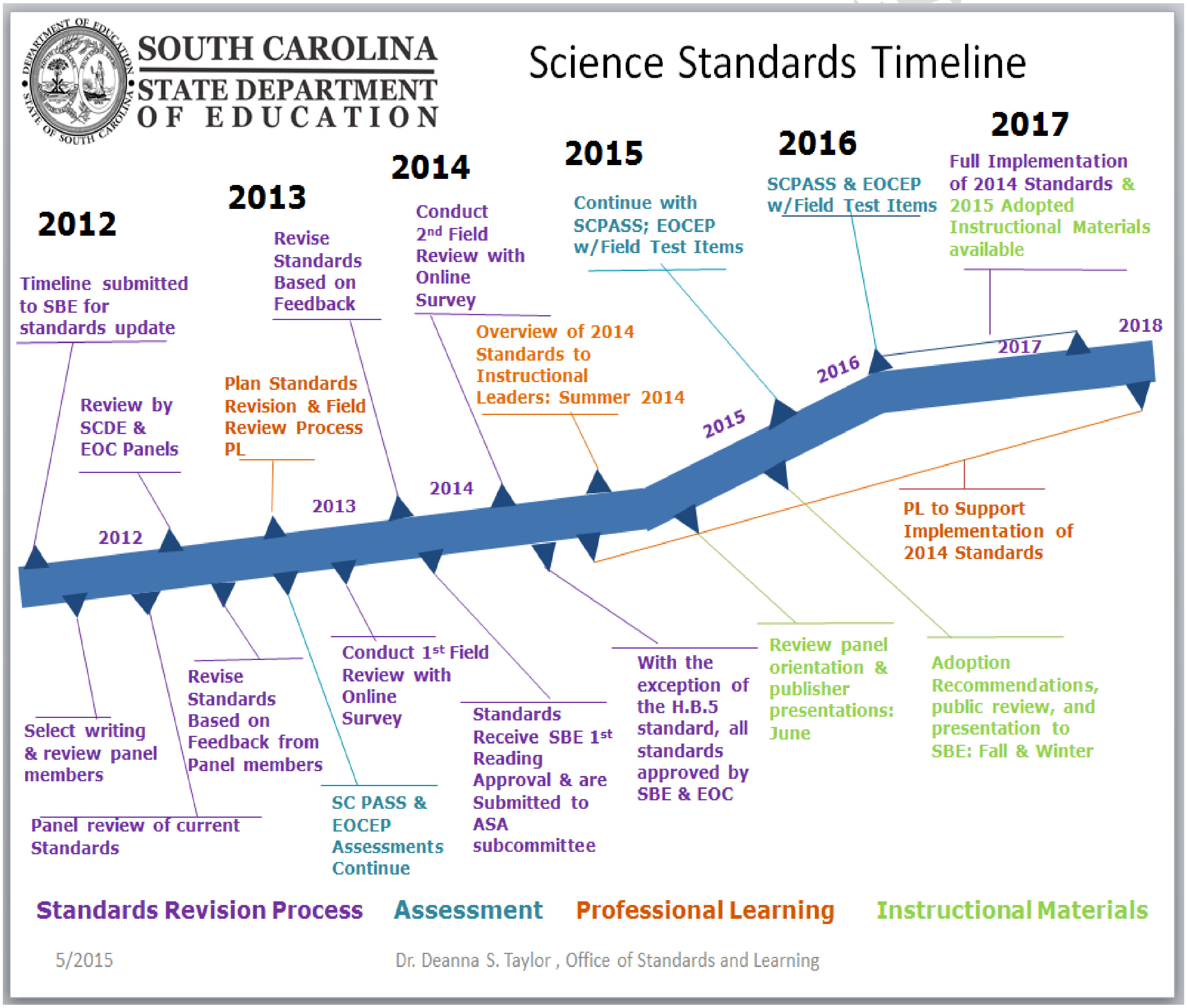
transformSC
tomorrow won't wait for our students

AN INITIATIVE OF SOUTH CAROLINA COUNCIL ON COMPETITIVENESS

SCIENCE STANDARDS TIMELINE

This timeline is used to illustrate the timeline for the standards revisions process, student assessment administration, provision of professional learning and the review and adoption of instructional materials. This timeline may be used with the science academic standards, science and engineering support document, and grade/content support documents to assist local districts, schools and teachers as they construct standards-based science curriculum, allowing them to add or expand topics they feel are important and to organize content to fit their students' needs and match available instructional materials.

The timeline in this document does not offer a sequence for instruction and do not prescribe classroom activities; materials; or instructional strategies, approaches, or practices. The *Science Standards Timeline*, is not a curriculum.



CROSSCUTTING CONCEPTS

Seven common threads or themes are presented in *A Framework for K-12 Science Education* (2012). These concepts connect knowledge across the science disciplines (biology, chemistry, physics, earth and space science) and have value to both scientists and engineers because they identify universal properties and processes found in all disciplines. These crosscutting concepts are:

1. Patterns
2. Cause and Effect: Mechanism and Explanation
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, Cycles, and Conservation
6. Structure and Function
7. Stability and Change

These concepts should not to be taught in isolation but reinforced in the context of instruction within the core science content for each grade level or course.

SCIENCE AND ENGINEERING PRACTICES

In addition to the academic standards, each grade level or high school course explicitly identifies S*cience and Engineering Practice* standards, with indicators that are differentiated across grade levels and core areas. The term "practice" is used instead of the term "skill," to emphasize that scientists and engineers use skill and knowledge simultaneously, not in isolation. These eight science and engineering practices are:

1. Ask questions and define problems
2. Develop and use models
3. Plan and conduct investigations
4. Analyze and interpret data
5. Use mathematical and computational thinking
6. Construct explanations and design solutions
7. Engage in scientific argument from evidence
8. Obtain, evaluate, and communicate information

Students should engage in scientific and engineering practices as a means to learn about the specific topics identified for their grade levels and courses. It is critical that educators understand that the Science and Engineering Practices are *not* to be taught in isolation. There should *not* be a distinct "Inquiry" unit at the beginning of each school year. Rather, the practices need to be employed ***within the content*** for each grade level or course.

Additionally, an important component of all scientists and engineers' work is communicating their results both by informal and formal speaking and listening, and formal reading and writing. Speaking, listening, reading and writing is important not only for the purpose of sharing results, but because during the processes of reading, speaking, listening and writing, scientists and engineers continue to construct their own knowledge and understanding of meaning and implications of their research. Knowing how one's results connect to previous results and what those connections reveal about the underlying principles is an important part of the scientific discovery process. Therefore, students should similarly be reading, writing, speaking and listening throughout the scientific processes in which they engage.

For additional information regarding the development, use and assessment of the *2014 Academic Standards and Performance Indicators for Science* please see the official document that is posted on the SCDE science web page--- http://tinyurl.com/2014SCScience.

DECIPHERING THE STANDARDS

KINDERGARTEN
LIFE SCIENCE: EXPLORING ORGANISMS AND THE ENVIRONMENT

Standard K.L.2: The student will demonstrate an understanding of organisms found in the environment and how these organisms depend on the environment to meet those needs.

K.L.2A. Conceptual Understanding: The environment consists of many types of organisms including plants, animals, and fungi. Organisms depend on the land, water, and air to live and grow. Plants need water and light to make their own food. Fungi and animals cannot make their own food and get energy from other sources. Animals (including humans) use different body parts to obtain food and other resources needed to grow and survive. Organisms live in areas where their needs for air, water, nutrients, and shelter are met.

Performance Indicators: Students who demonstrate this understanding can:

K.L.2A.1 Obtain information to answer questions about different organisms found in the environment (such as plants, animals, or fungi).

K.L.2A.2 Conduct structured investigations to determine what plants need to live and grow (including water and light).

Figure 1: Example from the Kindergarten Standards

The code assigned to each performance indicator within the standards is designed to provide information about the content of the indicator. For example, the **K.L.2A.1** indicator decodes as the following--

- **K: The first part of each indicator denotes the grade or subject.** The example indicator is from Kindergarten. The key for grade levels are as follows—
  - K: Kindergarten
  - 1: First Grade
  - 2: Second Grade
  - 3: Third Grade
  - 4: Fourth Grade
  - 5: Fifth Grade
  - 6: Sixth Grade
  - 7: Seventh Grade
  - 8: Eighth Grade
  - H.B: High School Biology 1
  - H.C: High School Chemistry 1
  - H.P: High School Physics 1
  - H.E: High School Earth Science

- **L: After the grade or subject, the content area is denoted by an uppercase letter.** The L in the example indicator means that the content covers Life Science. The key for content areas are as follows—

  E: Earth Science
  EC: Ecology
  L: Life Science
  P: Physical Science
  S: Science and Engineering Practices

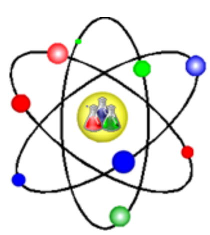
- **2: The number following the content area denotes the specific academic standard.** In the example, the 2 in the indicator means that it is within the second academic standard with the Kindergarten science content.

- **A: After the specific content standard, the conceptual understanding is denoted by an uppercase letter.** The conceptual understanding is a statement of the core idea for which students should demonstrate understanding. There may be more than one conceptual understanding per academic standard. The A in the example means that this is the first conceptual understanding for the standard. Additionally, the conceptual understandings are novel to the *2014 South Carolina Academic Standards and Performance Indicators for Science*.

- **1: The last part of the code denotes the number of the specific performance indicator.** Performance indicators are statements of what students can do to demonstrate knowledge of the conceptual understanding. The example discussed is the first performance indicator within the conceptual understanding.

CORE AREAS OF GRADE THREE

- Properties and Changes in Matter
- Energy Transfer – Electricity and Magnetism
- Earth's Materials and Resources
- Environments and Habitats



GRADE THREE
SCIENCE AND ENGINEERING PRACTICES

NOTE: Scientific investigations should always be done in the context of content knowledge expected at this grade level. The standard describes how students should learn and demonstrate knowledge of the content outlined in the other standards.

Standard 3.S.1: The student will use the science and engineering practices, including the processes and skills of scientific inquiry, to develop understandings of science content.

3.S.1A. Conceptual Understanding: The practices of science and engineering support the development of science concepts, develop the habits of mind that are necessary for scientific thinking, and allow students to engage in science in ways that are similar to those used by scientists and engineers.

Performance Indicators: Students who demonstrate this understanding can:

3.S.1A.1 Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs.

3.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.

3.S.1A.3 Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.

3.S.1A.4 Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.

3.S.1A.5 Use mathematical and computational thinking to (1) express quantitative observations using appropriate English or metric units, (2) collect and analyze data, or (3) understand patterns, trends and relationships.

3.S.1A.6 Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.

3.S.1A.7 Construct scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.

3.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.

3.S.1B. Conceptual Understanding: Technology is any modification to the natural world created to fulfill the wants and needs of humans. The engineering design process involves a series of iterative steps used to solve a problem and often leads to the development of a new or improved technology.

Performance Indicators: Students who demonstrate this understanding can:

3.S.1B.1 Construct devices or design solutions to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the devices or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.

PHYSICAL SCIENCE: PROPERTIES AND CHANGES IN MATTER

Standard 3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

3.P.2A. Conceptual Understanding: Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicators: Students who demonstrate this understanding can:

3.P.2A.1 Analyze and interpret data from observations and measurements to describe and compare the physical properties of matter (including length, mass, temperature, and volume of liquids).

3.P.2A.2 Construct explanations using observations and measurements to describe how matter can be classified as a solid, liquid or gas.

3.P.2A.3 Plan and conduct scientific investigations to determine how changes in heat (increase or decrease) change matter from one state to another (including melting, freezing, condensing, boiling, and evaporating).

3.P.2A.4 Obtain and communicate information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.

3.P.2A.5 Define problems related to heat transfer and design devices or solutions that facilitate (conductor) or inhibit (insulator) the transfer of heat.

PHYSICAL SCIENCE: ENERGY TRANSFER – ELECTRICITY AND MAGNETISM

Standard 3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

3.P.3A. Conceptual Understanding: Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.

Performance Indicators: Students who demonstrate this understanding can:

3.P.3A.1 Obtain and communicate information to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).

3.P.3A.2 Develop and use models to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).

3.P.3A.3 Analyze and interpret data from observations and investigations to classify different materials as either an insulator or conductor of electricity.

3.P.3B. Conceptual Understanding: Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An electromagnet is produced when an electric current passes through a coil of wire wrapped around an iron core. Magnets and electromagnets have unique properties.

Performance Indicators: Students who demonstrate this understanding can:

3.P.3B.1 Develop and use models to describe and compare the properties of magnets and electromagnets (including polarity, attraction, repulsion, and strength).

3.P.3B.2 Plan and conduct scientific investigations to determine the factors that affect the strength of an electromagnet.

EARTH SCIENCE: EARTH'S MATERIALS AND PROCESSES

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

3.E.4A. Conceptual Understanding: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.

Performance Indicators: Students who demonstrate this understanding can:

3.E.4A.1 Analyze and interpret data from observations and measurements to describe and compare different Earth materials (including rocks, minerals, and soil) and classify each type of material based on its distinct physical properties.

3.E.4A.2 Develop and use models to describe and classify the pattern distribution of land and water features on Earth.

3.E.4A.3 Obtain and communicate information to exemplify how humans obtain, use, and protect renewable and nonrenewable Earth resources.

3.E.4B. Conceptual Understanding: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

Performance Indicators: Students who demonstrate this understanding can:

3.E.4B.1 Develop and use models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, plains, and islands.

3.E.4B.2 Plan and conduct scientific investigations to determine how natural processes (including weathering, erosion, and gravity) shape Earth's surface.

3.E.4B.3 Obtain and communicate information to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment.

3.E.4B.4 Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.

LIFE SCIENCE: ENVIRONMENTS AND HABITATS

Standard 3.L.5: The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

3.L.5A. Conceptual Understanding: The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.

Performance Indicators: Students who demonstrate this understanding can:

3.L.5A.1 Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.

3.L.5A.2 Develop and use a food chain model to classify organisms as producers, consumers, and decomposers and to describe how organisms obtain energy.

3.L.5B. Conceptual Understanding: When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

Performance Indicators: Students who demonstrate this understanding can:

3.L.5B.1 Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.

3.L.5B.2 Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).

3.L.5B.3 Construct scientific arguments using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments.

GRADE THREE CROSSWALK FOR THE 2005 SOUTH CAROLINA SCIENCE ACADEMIC STANDARDS AND THE 2014 SOUTH CAROLINA ACADEMIC STANDARDS AND PERFORMANCE INDICATORS FOR SCIENCE

Click HERE to return to the Table of Contents

ACKNOWLEDGEMENTS

SOUTH CAROLINA DEPARTMENT OF EDUCATION

The *Crosswalks for the South Carolina Academic Standards and Performance Indicators for Science* included in this document were developed under the direction of Dr. Julie Fowler, Deputy Superintendent, Division of College and Career Readiness and Cathy Jones Stork, Interim Director, Office of Standards and Learning.

The following South Carolina Department of Education (SCDE) staff members collaborated in the development of this document:

Dr. Deanna S. Taylor
Education Associate
Office of Standards and Learning

Dr. Regina E. Wragg
Education Associate
Office of Standards and Learning

CROSSWALK DOCUMENT REVIEW & REVISION TEAM

The following SC Educators collaborated with the SCDE to review and revise the *Crosswalks for the South Carolina Academic Standards and Performance Indicators for Science*, and their time, service, and expertise are appreciated.

Kelli Bellant (Clarendon 2)
Elizabeth Boland (Lex/Rich 5)
Michael Carothers (Lex/Rich 5)
Jami Cummings (Spartanburg 7)
Cleva Garner (Greenwood)
Constantina Green (Richland 1)
James Lillibridge (Charleston)
Jennifer McLeod (Richland 2)

Cheryl Milford (Orangeburg 3)
Jason Osborne (Beaufort)
Dominique Ragland (SCPC)
Kourtney Shumate (Darlington)
Tonya Smith (Richland 1)
Amy Steigerwalt (Charleston)
Tonya Swalgren (Lexington 1)
Pamela Vereen (Georgetown)

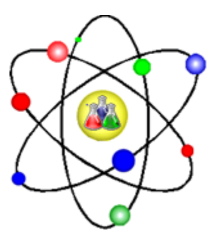
INTRODUCTION

This document, *Crosswalks for the 2005 South Carolina Science Academic Standards and the 2014 South Carolina Academic Standards and Performance Indicators for Science*, contains a comparison of the academic standards in science for the state's students in kindergarten through grade twelve.

HOW TO USE THE CROSSWALKS

This document may be used with the science academic standards, science and engineering support document, and grade/content support documents to assist local districts, schools and teachers as they construct standards-based science curriculum, allowing them to add or expand topics they feel are important and to organize content to fit their students' needs and match available instructional materials. 2005 and 2014 performance indicators that share similar content knowledge and skills that students should demonstrate to meet the grade level or high school course standards have been paired. These pairings have been organized into tables and are sequenced by the 2014 academic standards. The 2005 content indicators that do not match 2014 content have been placed at the end of each table.

The academic standards in this document are not sequenced for instruction and do not prescribe classroom activities; materials; or instructional strategies, approaches, or practices. The *Crosswalks for the 2005 South Carolina Science Academic Standards and the 2014 South Carolina Academic Standards and Performance Indicators for Science*, is not a curriculum.



GRADE 3 SCIENCE CROSSWALK DOCUMENT

(***** The 2005 content indicators that do not match 2014 content have been placed at the end of each table.)

2005	2014	Comments
	Standard (Science & Engineering Practices)	
3-1: The student will demonstrate an understanding of scientific inquiry, including the processes, skills, and mathematical thinking necessary to conduct a simple scientific investigation.	**3.S.1:** The student will use the science and engineering practices, including the processes and skills of scientific inquiry, to develop understandings of science content.	In 2005 this standard and these indicators were referred to as "scientific inquiry"
	Conceptual Understanding	
	3.S.1A. The practices of science and engineering support the development of science concepts, develop the habits of mind that are necessary for scientific thinking, and allow students to engage in science in ways that are similar to those used by scientists and engineers.	
	Performance Indicators	
3-1.3 Generate questions such as "what if?" or "how?" about objects, organisms, and events in the environment and use those questions to conduct a simple scientific investigation.	**3.S.1A.1** Ask questions that can be (1) answered using scientific investigations or (2) used to refine models, explanations, or designs.	
	3.S.1A.2 Develop, use, and refine models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others.	This is a new expectation in 2014 standards
3-1.4 Predict the outcome of a simple investigation and compare the result with the prediction. 3-1.5 Use tools (including beakers, meter tapes and sticks, forceps/tweezers, tuning forks, graduated cylinders, and graduated syringes) safely, accurately, and appropriately when gathering specific data.	**3.S.1A.3** Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative	Identifying variables is a new expectation in the 2014 standards Gathering data was a skill used with the 2005 standards, the use of the vocabulary collect qualitative and quantitative is a new expectation in the 2014 standards

3-1.8 Use appropriate safety procedures when conducting investigations.	data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.	
3-1.7 Explain why similar investigations might produce different results.	**3.S.1A.4** Analyze and interpret data from observations, measurements, or investigations to understand patterns and meanings.	
	3.S.1A.5 Use mathematical and computational thinking to (1) express quantitative observations using appropriate English or metric units, (2) collect and analyze data, or (3) understand patterns, trends and relationships.	This is a new expectation in 2014 standards
3-1.6 Infer meaning from data communicated in graphs, tables, and diagrams.	**3.S.1A.6** Construct explanations of phenomena using (1) scientific evidence and models, (2) conclusions from scientific investigations, (3) predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams.	
	3.S.1A.7 Construct scientific arguments to support claims, explanations, or designs using evidence from observations, data, or informational texts.	This is a new expectation in 2014 standards
	3.S.1A.8 Obtain and evaluate informational texts, observations, data collected, or discussions to (1) generate and answer questions, (2) understand phenomena, (3) develop models, or (4) support explanations, claims, or designs. Communicate observations and explanations using the conventions and expectations of oral and written language.	This is a new expectation in 2014 standards
	Conceptual Understanding	
	3.S.1B. Technology is any modification to the natural world created to fulfill the wants and needs of humans. The engineering design process involves a series of iterative steps used to solve a problem and often leads to the development of a new or improved technology.	

Performance Indicators		
	3.S.1B.1 Construct devices or design solutions to solve specific problems or needs: (1) ask questions to identify problems or needs, (2) ask questions about the criteria and constraints of the devices or solutions, (3) generate and communicate ideas for possible devices or solutions, (4) build and test devices or solutions, (5) determine if the devices or solutions solved the problem and refine the design if needed, and (6) communicate the results.	This is a new expectation in 2014 standards

*****3-1.1 Classify objects by two of their properties (attributes).
*3-1.2 Classify objects or events in sequential order.

2005	2014	Comments
	Standard (Physical Science)	
3-4: The student will demonstrate an understanding of the changes in matter that are caused by heat.	**3.P.2:** The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.	
	Conceptual Understanding	
	3.P.2A. Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.	
	Performance Indicators	
3-4.1 Classify different forms of matter (including solids, liquids, and gases) according to their observable and measurable properties.	**3.P.2A.1** Analyze and interpret data from observations and measurements to describe and compare the physical properties of matter (including length, mass, temperature, and volume of liquids).	
3-4.1 Classify different forms of matter (including solids, liquids, and gases) according to their observable and measurable properties.	**3.P.2A.2** Construct explanations using observations and measurements to describe how matter can be classified as a solid, liquid or gas.	
3-4.2 Explain how water and other substances change from one state to another (including melting, freezing, condensing, boiling, and evaporating).	**3.P.2A.3** Plan and conduct scientific investigations to determine how changes in heat (increase or decrease) change matter from one state to another (including melting, freezing, condensing, boiling, and evaporating).	
3-4.4 Identify sources of heat and exemplify ways that heat can be produced (including rubbing, burning, and using electricity).	**3.P.2A.4** Obtain and communicate information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.	
3-4.3 Explain how heat moves easily from one object to another through direct contact in some materials (called conductors) and not so easily through other materials (called insulators).	**3.P.2A.5** Define problems related to heat transfer and design devices or solutions that facilitate (conductor) or inhibit (insulator) the transfer of heat.	

2005	2014	Comments
	Standard (Physical Science)	
	3.P.3: The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.	
	Conceptual Understanding	
	3.P.3A. Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.	
	Performance Indicators	
4-5.5 Explain how electricity, as a form of energy, can be transformed into other forms of energy (including light, heat, and sound).	**3.P.3A.1** Obtain and communicate information to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).	This is a new expectation in 2014 standards
4-5.6 Summarize the functions of the components of complete circuits (including wire, switch, battery, and light bulb). 4-5.7 Illustrate the path of electric current in series and parallel circuits.	**3.P.3A.2** Develop and use models to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).	This is a new expectation in 2014 standards
3-4.3 Explain how heat moves easily from one object to another through direct contact in some materials (called conductors) and not so easily through other materials (called insulators). 4-5.8 Classify materials as either conductors or insulators of electricity.	**3.P.3A.3** Analyze and interpret data from observations and investigations to classify different materials as either an insulator or conductor of electricity.	
	Conceptual Understanding	
	3.P.3B. Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An	

	electromagnet is produced when an electric current passes through a coil of wire wrapped around an iron core. Magnets and electromagnets have unique properties.	
Performance Indicators		
4-5.9 Summarize the properties of magnets and electromagnets (including polarity, attraction/repulsion, and strength).	**3.P.3B.1** Develop and use models to describe and compare the properties of magnets and electromagnets (including polarity, attraction, repulsion, and strength).	This is a new expectation in 2014 standards
4-5.10 Summarize the factors that affect the strength of an electromagnet.	**3.P.3B.2** Plan and conduct scientific investigations to determine the factors that affect the strength of an electromagnet.	This is a new expectation in 2014 standards

*****3-5.1 Identify the position of an object relative to a reference point by using position terms such as "above," "below," "inside of," "underneath," or "on top of" and a distance scale or measurement.
*3-5.2 Compare the motion of common objects in terms of speed and direction.
*3-5.4 Explain the relationship between the motion of an object and the pull of gravity.
*3-5.5 Recall that vibrating objects produce sound and that vibrations can be transferred from one material to another.
*3-5.6 Compare the pitch and volume of different sounds.
*3-5.7 Recognize ways to change the volume of sounds.
*3-5.8 Explain how the vibration of an object affects pitch.

2005	2014	Comments
	Standard (Earth Science)	
Standard 3-3: The student will demonstrate an understanding of Earth's composition and the changes that occur to the features of Earth's surface.	**3.E.4:** The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.	
	Conceptual Understanding	
	3.E.4A. Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.	
	Performance Indicators	
3-3.1 Classify rocks (including sedimentary, igneous, and metamorphic) and soils (including humus, clay, sand, and silt) on the basis of their properties. 3-3.2 Identify common minerals on the basis of their properties by using a minerals identification key.	**3.E.4A.1** Analyze and interpret data from observations and measurements to describe and compare different Earth materials (including rocks, minerals, and soil) and classify each type of material based on its distinct physical properties.	
3-3.5 Illustrate Earth's saltwater and freshwater features (including oceans, seas, rivers, lakes, ponds, streams, and glaciers).	**3.E.4A.2** Develop and use models to describe and classify the pattern distribution of land and water features on Earth.	
3-3.7 Exemplify Earth materials that are used as fuel, as a resource for building materials, and as a medium for growing plants.	**3.E.4A.3** Obtain and communicate information to exemplify how humans obtain, use, and protect renewable and nonrenewable Earth resources.	This is a new expectation in 2014 standards
	Conceptual Understanding	
	3.E.4B. Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.	
	Performance Indicators	
3-3.6 Illustrate Earth's land features (including volcanoes, mountains, valleys, canyons, caverns, and islands) by using models, pictures, diagrams, and **maps.**	**3.E.4B.1** Develop and use models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, plains, and islands.	
3-3.8 Illustrate changes in Earth's	**3.E.4B.2** Plan and conduct scientific	

surface that are due to slow processes (including weathering, erosion, and deposition) and changes that are due to rapid processes (including landslides, volcanic eruptions, floods, and earthquakes).	investigations to determine how natural processes (including weathering, erosion, and gravity) shape Earth's surface.	
	3.E.4B.3 Obtain and communicate information to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment.	This is a new expectation in 2014 standards
	3.E.4B.4 Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment.	This is a new expectation in 2014 standards

*****3-3.3 Explain how the motion of an object is affected by the strength of a push or pull and the mass of the object.
*3-3.4 Explain the relationship between the motion of an object and the pull of gravity.

2005	2014	Comments
	Standard (Life Science)	
3-2: The student will demonstrate an understanding of the structures, characteristics, and adaptations of organisms that allow them to function and survive within their habitats.	**3.L.5:** The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.	
	Conceptual Understanding	
	3.L.5A. The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets its energy.	
	Performance Indicators	
3-2.3 Recall the characteristics of an organism's habitat that allow the organism to survive there.	**3.L.5A.1** Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.	
3-2.5 Summarize the organization of simple food chains (including the roles of producers, consumers, and decomposers).	**3.L.5A.2** Develop and use a food chain model to classify organisms as producers, consumers, and decomposers and to describe how organisms obtain energy.	
	Conceptual Understanding	
	3.L.5B. When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.	
	Performance Indicators	
3-2.3 Recall the characteristics of an	**3.L.5B.1** Obtain and communicate	

Click HERE to return to the Table of Contents

organism's habitat that allow the organism to survive there.	information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.	
3-2.2 Explain how physical and behavioral adaptations allow organisms to survive (including hibernation, defense, locomotion, movement, food obtainment, and camouflage for animals and seed dispersal, color, and response to light for plants).	**3.L.5B.2** Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).	Changes in a habitat cause plants and animals to respond in different ways (new responses include; migrating, death, or extinction)
3-3.3 Recognize types of fossils (including molds, casts, and preserved parts of plants and animals). 3-3.4 Infer ideas about Earth's early environments from fossils of plants and animals that lived long ago.	**3.L.5B.3** Construct scientific arguments using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments.	Moved from Earth Science in 2005 document to Life Science in 2014 document

*3-2.1 Illustrate the life cycles of seed plants and various animals and summarize how they grow and are adapted to conditions within their habitats.

CONTENT SUPPORT GUIDE
FOR GRADE THREE
SOUTH CAROLINA ACADEMIC STANDARDS AND PERFORMANCE INDICATORS FOR SCIENCE

ACKNOWLEDGEMENTS

South Carolina owes a debt of gratitude to the following individuals for their assistance in the development of the Kindergarten Content Support Guide for the *South Carolina Academic Standards and Performance Indicators for Science.*

SOUTH CAROLINA DEPARTMENT OF EDUCATION

The explication of the standards and performance indicators included in this document were developed under the direction of Dr. Julie Fowler, Deputy Superintendent, Division of College and Career Readiness and Cathy Jones Stork, Interim Director, Office of Standards and Learning.

The following South Carolina Department of Education (SCDE) staff members collaborated in the development of this document:

Dr. Deanna S. Taylor
Education Associate
Office of Standards and Learning

Dr. Regina E. Wragg
Education Associate
Office of Standards and Learning

GRADE 3 CONTENT SUPPORT GUIDE DEVELOPMENT TEAM

The following SC Educators collaborated with the SCDE to develop and draft the *Content Support Guide for the South Carolina Academic Standards and Performance Indicators for Science*, and their efforts and input are appreciated.

Kelli Bellant, Coordinator (Clarendon 2)
Bronwen Bethea (Charleston)
Cleva Garner (Greenwood)
Amanda Williamson (Clarendon 2)
Debbie Bishop, Coordinator (Laurens 55)
Jason Osborne, Template Keeper (Beaufort)
Amy Elkins (Barnwell 45)
Barbara Koch (Anderson 5)
Kelly Morse (Saluda)
Mina Brooks, Coordinator (Newberry)
Jami Cummings, Template Keeper (Spartanburg 7)
Anna MacDermut (EdVenture)
Tammy Martin (Horry)
Mary Robinson (Orangeburg 5)
Mirandi O. Squires (Florence 5)

CONTENT SUPPORT GUIDE REVISION TEAM

The following SC Educators collaborated with the SCDE to review, revise and compile the *Content Support Guides for the South Carolina Academic Standards and Performance Indicators for Science*, and their time, service and expertise are appreciated.

Kelli Bellant (Clarendon 2)
Elizabeth Boland (Lex/Rich 5)
Michael Carothers (Lex/Rich 5)
Jami Cummings (Spartanburg 7)
Cleva Garner (Greenwood)
Constantina Green (Richland 1)
James Lillibridge (Charleston)
Jennifer McLeod (Richland 2)
Cheryl Milford (Orangeburg 3)
Jason Osborne (Beaufort)
Dominique Ragland (SCPC)
Kourtney Shumate (Darlington)
Tonya Smith (Richland 1)
Amy Steigerwalt (Charleston)
Tonya Swalgren (Lexington 1)
Pamela Vereen (Georgetown)

Click HERE to return to the Table of Contents

The SCDE would like to acknowledge the following members from the Office of Assessment at the South Carolina Department of Education (SCDE) for their expertise and assistance with the development of this document:

Amelia Brailsford, Education Associate
Dr. Kirsten Hural, Education Associate
Llewellyn Shealy, Education Associate

INTRODUCTION

Local districts, schools and teachers may use this document to construct standards-based science curriculum, allowing them to add or expand topics they feel are important and to organize content to fit their students' needs and match available instructional materials. The support document includes essential knowledge, extended knowledge, connections to previous and future knowledge, and assessment recommendations.

FORMAT OF THE CONTENT SUPPORT GUIDE

The format of this document is designed to be structurally uniformed for each of the academic standards and performance indicators. For each, you will find the following sections--

- **Standard**
  - This section provides the standard being explicated.
- **Conceptual Understanding**
  - This section provides the overall understanding that the student should possess as related to the standard. Additionally, the conceptual understandings are novel to the *2014 South Carolina Academic Standards and Performance Indicators for Science*.
- **Performance Indicator**
  - This section provides a specific set of content with an associated science and engineering practice for which the student must demonstrate mastery.
- **Assessment Guidance**
  - This section provides guidelines for educators and assessors to check for student mastery of content utilizing interrelated science and engineering practices.
- **Previous and Future Knowledge**
  - This section provides a list of academic content along with the associated academic standard that students will have received in prior or will experience in future grade levels. Please note that the kindergarten curriculum support document does not contain previous knowledge. Additionally, although the high school support document may not contain future knowledge, this section may list overlapping concepts from other high school science content areas.
- **Essential Knowledge**
  - This section illustrates the knowledge of the content contained in the performance indicator for which it is fundamental for students to demonstrate mastery.
- **Extended Knowledge**
  - This section provides educators with topics that will enrich students' knowledge related to topics learned with the explicated performance indicator.
- **Science and Engineering Practices**
  - This section lists the specific science and engineering practice that is paired with the content in the performance indicator. Educators should reference the chapter on this specific science and engineering practice in the *Science and Engineering Practices Support Guide.*

GRADE 3 SCIENCE CONTENT SUPPORT GUIDE

Standard
3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

Conceptual Understanding
3.P.2A Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicator
3.P.2A.1 Analyze and interpret data from observations and measurements to describe and compare the physical properties of matter (including length, mass, temperature, and volume of liquids).

Assessment Guidance
The objective of this indicator is to *analyze and interpret data* from observations and measurements to describe and compare physical properties of matter (including length, mass, temperature, and volume of liquids). Therefore, the primary focus of assessment should be for students use observations, measurements or investigations to describe matter using physical properties. This could include, but is not limited to students analyzing various items placed in black film canisters such as water, marbles, and paper clips, etc. Before looking inside of the canisters, students can form questions about the canisters and what could be inside. After observations are made, students may open the canister to reveal the contents. Students then should compare and contrast their observations from before and after opening the black film canisters. Students should be able to describe why they analyzed the data as they did.

In addition to *analyzing and interpreting data*, students should *ask questions to plan and carry out investigations; use mathematical and computational thinking; engage in argument from evidence and construct explanations; develop and use models;* and *obtain, evaluate, and communicate information.*

Previous and Future Knowledge
- K.P.4 Observable Properties of Matter
- 2.P.3, 5.P.2 Properties of Matter
- 7.P.2 Describing and Classifying Matter

Essential Knowledge
It is essential for students to analyze and interpret data demonstrating that ***matter*** is anything that has mass and takes up space. ***Properties*** of matter are characteristics that can be used to describe matter. Properties can be observable or measurable.

Observable Properties(using senses)
(Using sense of sight): color, size, shape, shininess or luster
(Using sense of touch): texture or relative hotness or coldness
(Using sense of smell): odor present or not

Measurable Properties (using tools)
(Using balance): mass
(Using graduated cylinder or syringe, or beaker): volume
(Using thermometer): temperature

(Using ruler, tape measure, meter stick): length

Students also need to have knowledge of the following properties of matter.

Length

- *Length* is the measurement of something from end to end.
- Length can be measured using a ruler, tape measure, or meter stick.
- An object with a greater length will extend past an object with a lesser length.

Mass

- *Mass* is how much matter is in an object.
- Mass can be measured using a *balance* with known masses compared to the unknown mass being measured.
- An object with a large mass feels heavier than an object with a smaller mass.

Temperature

- *Temperature* is a measure of heat in an object,
- Temperature can be measured using a thermometer.
- An object with a greater temperature feels hotter to the touch than an object with a lower temperature.

Volume

- *Volume* is the amount of space an object takes up.
- Volume of a liquid can be measured with a beaker, graduated cylinder or graduated syringe.
- An object that takes up more space has a greater volume than an object that takes up less space.

NOTE TO TEACHER: This may be an opportunity for students to estimate and measure liquid volumes (capacity) in metric units (mL, L) to the nearest whole unit.

*SCIENTIFIC TOOLS used to make observations and measurements to describe and compare the physical properties of matter (magnifier, metric ruler, tape measure, meter stick, beaker, graduated cylinder, graduated syringe, balance, mass-weights, thermometer)

Extended Knowledge

- Matter is made up of particles called atoms which are too small to be seen.
- Scientists can make inferences about matter, even if the matter is too small to be seen, by observing other properties.

Science and Engineering Practices

S.1.A.4

Standard

3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

Conceptual Understanding

3.P.2A Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicator
3.P.2A.2 Construct explanations using observations and measurements to describe how matter can be classified as a solid, liquid or gas.

Assessment Guidance
The objective of the indicator is to *construct explanations using observations and measurements* to describe how matter can be classified as a solid, liquid or gas. Therefore, the primary focus of assessment should be for students to construct explanations of phenomena using scientific evidence and models, conclusions from scientific investigations, predictions based on observations and measurements, or data communicated in graphs, tables, or diagrams. Students explain that *matter* is classified into the following forms (solids, liquids, and gases) based on observable and measurable properties. This could include, but is not limited to students conducting investigations with water and temperature change (heating or freezing) to gather data as a means to describe how matter can be classified.

In addition to *constructing explanations and using observations and measurements*, students should ask questions to plan and carry out investigations; use mathematical and computational thinking; engage in argument from evidence and construct explanations; develop and use models and obtain, evaluate, and communicate information; and construct devices or design solutions.

Previous and Future Knowledge
- K.P.4 Observation
- 2.P.3 Properties of Matter
- 7.P.2 Describing and Classifying; physical properties

Essential Knowledge
It is essential for students to construct explanations and use observations and measurements to explain that *matter* is classified into the following forms based on observable and measurable properties:
- *Solids* have a definite size and shape, meaning the size and shape do not change. Measurable properties of solids could include length, temperature, mass and volume.
- *Liquids* have a definite volume, but they take the shape of their containers. Measurable properties of liquids could include temperature, mass and volume.
- *Gases* do not have a definite shape, nor volume. Gases take the shape and size of their container. Measurable properties of gases include temperature and mass.

Extended Knowledge
Plasma is the 4^{th} state of matter. It is the most common state of matter in the universe. The sun and other stars are made of plasma.

Science and Engineering Practices
S.1.A.6

Standard
3.P.2 The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

Conceptual Understanding
3.P.2 Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicator
3.P.2A.3 Plan and conduct scientific investigations to determine how changes in heat (increase or decrease) change matter from one state to another (including melting, freezing, condensing, boiling, and evaporating).

Assessment Guidance
The primary objective of the indicator is to *plan and conduct scientific investigations* to determine how increases or decreases in heat changes matter from one state to another (including melting, freezing, condensing, boiling, and evaporating). Therefore, the primary focus of the assessment should be for students to plan and conduct scientific investigations to answer questions, test predictions and develop explanations. This could include, but is not limited to having students formulate scientific questions and predict possible outcomes, identify materials, procedures, and variables, select and use appropriate tools or instruments to collect qualitative and quantitative data. In the end, students' scientific investigations will determine how changes in temperature can change the states of matter. Example investigations could be done with freeze pops or ice cubes.

In addition, to *plan and conduct scientific investigations*, students should *ask questions; use mathematical and computational thinking; engage in argument from evidence and construct explanations; develop and use models and obtain, evaluate , and communicate information;* and *construct devices or design solutions.*

Previous and Future Knowledge
- 6.P.3 Heat Energy and heat transfer
- 7.P.2 States of Matter

Essential Knowledge
It is essential for students to plan and conduct investigations to discover that water and other substances can change from one state to another when heat is gained or lost. Substances change states at specific temperatures. The diagram below shows the relationship between heat and changes of state.

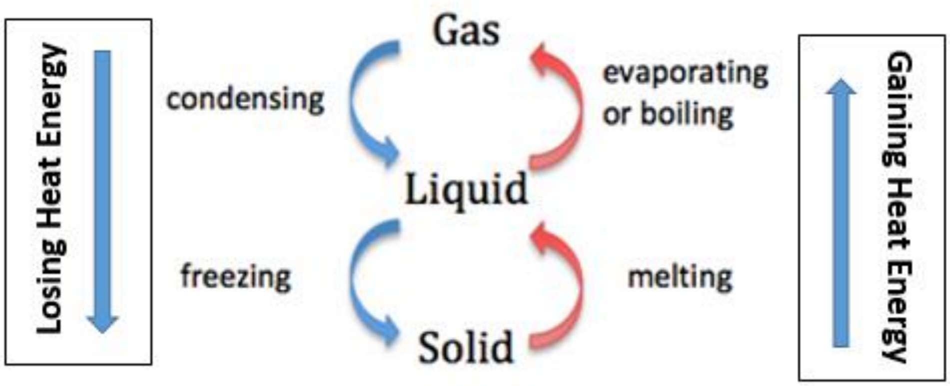


Image Source: Adapted from SC Science Academic Standards Support Document 2005

Melting
- *Melting* occurs when sufficient heat energy is added to change the solid to a liquid.

- Ice starts to *melt* at 0°C or 32°F
- Examples of solids that can be easily melted include ice, chocolate, and wax.

Freezing

- *Freezing* occurs when sufficient heat energy is removed to change the liquid to a solid.
- Water starts to freeze at 0°C or 32°F
- Water will expand when it freezes; most other substances contract.

Condensing

- *Condensing* is a change in state from a gas to a liquid.
- Condensing occurs when sufficient heat energy is removed to change a gas to a liquid.
- Examples of condensing include the formation of water droplets on the outside of a glass of cold liquid, or the formation of water droplets on the cool surface of a mirror during a warm shower. The water droplets that form during condensing are called ***condensation***.

Boiling

- *Boiling* is a change in state from a liquid to a *gas.*
- Boiling occurs when sufficient heat is added to a liquid causing bubble of gas to form within the liquid and rise to the surface.
- Boiling causes liquids to change to a gas more quickly than evaporation.
- Water starts to boil at 100°C or 212°F. When most substances are heated, they will expand and take up more space.

Evaporation

- *Evaporation* is a change in state from a liquid to a gas.
- Evaporation occurs at the surface of the liquid as heat is added from the surroundings
- Evaporation causes liquids to change to a gas more slowly than boiling.

Extended Knowledge

- Changes of state are *physical changes* in which the physical properties change, but the chemical identity of the substance remains the same.
- The Law of Conservation of Matter states that matter is neither created nor destroyed during physical or chemical change.
- Deposition is the change of state from a gas directly to a solid. Frost is an example of deposition.
- Sublimation is the change of state from a solid directly to a gas. Dry ice, which is solid carbon dioxide, is an example of a substance that sublimes.

Science and Engineering Practices

S.1.A.3

Standard

3.P.2 The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

Conceptual Understanding

3.P.2A Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicator

3.P.2A.4 Obtain and communicate information to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.

Click HERE to return to the Table of Contents

Assessment Guidance
The objective of the indicator is to *obtain and communicate information* to compare how different processes (including burning, friction, and electricity) serve as sources of heat energy.
Therefore, the primary focus of the assessment should be for students to obtain and evaluate informational texts, observations, data collected, or discussions to generate and answer questions. Students should understand phenomena, develop models, and support explanations, claims, or designs to explain that sources of heat produce heat energy and make things warmer. This could include but is not limited to students developing a model (source of data with drawings and/or photographs) to illustrate common objects in their environment that produce heat and show the processes that are the sources of heat energy.

In addition to *obtaining and communicating information*, students should *ask questions to plan and carry out investigations; use mathematical and computational thinking; engage in arguments from evidence and construct explanations; develop and use models to obtain, evaluate, and communicate information;* and *construct devices or design solutions.*

Previous and Future Knowledge
- 5.P.3 Friction
- 6.P.3 Different Forms of Energy

Essential Knowledge
Students should obtain and communicate information explaining that sources of heat produce heat energy and make things warmer. For example, fires, stoves, toasters, ovens, the Sun, light bulbs, engines, animals, and other common objects in their environment which produce heat.

Students should know that the processes of *burning*, *friction* and *electricity* produce heat energy. Students should compare how different processes serve as sources of heat energy.
Burning
- When materials are *burned*, heat can be produced. For example, when wood or candles are burned, they produce heat.

Friction
- *Friction* is the rubbing of two objects together.
- When objects are *rubbed* together, heat is produced. For example, when hands are *rubbed* together, they get warmer.

Electricity
- When *electricity* is used, heat can be produced. For example, when electricity is used in light bulbs, heaters, stoves, toasters, or ovens, they produce heat and the surfaces become warm.

Extended Knowledge
- Particles of matter move faster as the temperature increases, and move slower as temperature decreases.
- The amount of energy transfer needed to change the temperature of matter depends on the nature of the matter, the size of the matter, and the environment.
- Heat energy transfers from an area of higher temperature to an area of lower temperature

Science and Engineering Practices
S.1.A.8

Standard
3.P.2: The student will demonstrate an understanding of the properties used to classify matter and how heat energy can change matter from one state to another.

Conceptual Understanding
3.P.2A Matter exists in several different states and is classified based on observable and measurable properties. Matter can be changed from one state to another when heat (thermal energy) is added or removed.

Performance Indicator
3.P.2A.5 Define problems related to heat transfer and design devices or solutions that facilitate (conductor) or inhibit (insulator) the transfer of heat.

Assessment Guidance
The objective of the indicator is to define problems related to heat transfer and *design devices or solutions* that facilitate (conductor) or inhibit (insulator) the transfer of heat. Therefore, the primary focus of the assessment should be for students to ask questions to identify problems or needs, ask questions about the criteria and constraints of the devices or solutions, generate and communicate ideas for possible devices or solutions, then build and test devices or solutions. Furthermore, students determine if the devices or solutions solved the problem and refine the design if needed. Results are communicated to demonstrate how heat is a form of energy called thermal energy. This could include, but is not limited to students carrying out a design challenge with materials supplied by their teacher to inhibit an ice cube from melting with quantitative data (numbers) to support their designs.

In addition to defining problems and *designing devices or solutions*, students should *ask questions and plan and carry out investigations; use mathematical and computational thinking; engage in argument from evidence and construct explanations; and develop and use models;* and *obtain, evaluate, and communicate information*.

Previous and Future Knowledge
- 6.P.3 Conservation of energy and heat transfer

Essential Understanding
Heat is a form of thermal energy. Students should know that some types of materials allow heat to move (transfer) through them easily, and others do not. Heat only moves from hot objects to cold objects. Students should design solutions to solve problems relating to heat transfer using insulators and conductors.

Examples of problems relating to heat transfer could include, but are not limited to:
- A student's hot cocoa gets cold quickly when served in a paper cup.
- Students are burned while sliding down the metal slide at recess.
- Classroom laptops are overheating and turning off during use by students.

Students should know the following:

Conductors of Heat Transfer
- Conductors facilitate, or *conduct*, the transfer of heat energy.
- Materials that allow heat to move easily through them, and from one object to another through direct contact are called *conductors.*

- Metal objects are good *conductors* of heat because heat can transfer easily through the metal. For example, the handle of a metal spoon will become warm when the spoon is placed in hot water.

Insulators of Heat Transfer

- Insulators inhibit, or *insulate*, the transfer of heat energy.
- Materials that do not allow heat to move easily through them or from one object to another through direct contact are called *insulators*.
- Wooden and plastic objects are good *insulators* of heat because heat does not transfer easily through wood or plastic. For example, the handle of a wooden or plastic spoon does not become warm when the spoon is placed in hot water.
-

Extended Knowledge

- Students do not need to distinguish between the conductivity of different metals.
- Heat can be transferred through conduction, convection, and radiation.
-

Science and Engineering Practices

S.1.B.1

Standard

3.P.3 The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

Conceptual Understanding

3.P.3A Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.

Performance Indicator

3.P.3A.1 Obtain and communicate information to develop models showing how electrical energy can be transformed into other forms of energy (including motion, sound, heat, or light).

Assessment Guidance

The objective of the indicator is to *obtain and communicate information* to develop models showing how electrical energy can be transformed into other forms of energy. Therefore, the primary focus of the assessment should be for the students to obtain and evaluate informational texts, observations, data collected, or discussions to generate and answer questions, understand phenomena, develop models, or support explanations of how electricity is a form of energy that can be changed into other forms of energy, including motion, sound, heat, or light. This could include, but is not limited to students developing models from interpreting diagrams, illustrations, or electrical devices to explain or demonstrate electrical energy transformation into one or more forms.

In addition to *obtaining and communicating information,* students should be asked to *ask questions and plan and carry out investigations; use mathematical and computational thinking; engage in arguments from evidence and construct explanations; develop and use models and obtain, evaluate, and communicate information;* and *construct devices or design solutions*.

Previous and Future Knowledge

- 6.P.3 Energy Transfer

Essential Understanding

It is essential for students to obtain and communicate information demonstrating that electricity is a form of energy that can be changed into other forms of energy, including motion, sound, heat, or light.

Motion

- Electrical energy can be changed to energy of *motion* with an electric motor, such as an electric fan or hair dryer.

Sound

- Electrical energy can be changed to *sound energy* with radios and televisions.

Heat

- Electrical energy can be changed to *heat energy* in stoves, toasters, and ovens.

Light

- Electrical energy can be changed to *light energy* with light bulbs in lamps, televisions, and computer monitors.
-

Extended Knowledge

- Energy cannot be created or destroyed. It can, however, be transformed from one form into another. This is the conservation of energy.
- While electrical energy can be used to produce motion, the energy of motion can also be used to produce electrical energy. For example, the energy of moving water can be used to drive a spinning turbine that generates electric currents.

Science and Engineering Practices

S.1.A.8

Standard

3.P.3 The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

Conceptual Understanding

3.P.3A Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.

Performance Indicator

3.P.3A.2 Develop and use models to describe the path of an electric current in a complete simple circuit as it accomplishes a task (such as lighting a bulb or making a sound).

Assessment Guidance

The objective of the indicator is to *develop and use models* to describe the path of an electrical current in a complete simple circuit as it accomplishes a task. Therefore the primary focus of the assessment should be for the students to construct 2-D drawings/diagrams or 3-D models that represent or use simulations to investigate paths of an electrical current in a complete simple circuit. This could include, but is not limited to students developing a model or a diagram with symbols of the components of a simple circuit and using their diagram to explain how the electrical energy was changed to another form of energy.

In addition, to *developing and using models*, students should *ask questions; plan and carry out investigations; analyze and interpret data; use mathematical and computational thinking; engage in argument from evidence and construct explanations; obtain, evaluate, and communicate information;* and *construct devices or design solutions*.

Previous and Future Knowledge

- 6.P.3 Electrical Energy

Essential Knowledge

It is essential for students to develop and use models demonstrating that electric currents flowing through a complete *circuit* (a *closed* path through which electricity flows) can be used to accomplish a task, such as lighting a bulb or making a sound.

It is essential for students to know the components of a complete *circuit* including the wire, switch, battery, and a device that changes electric energy into another form of energy, such as a light bulb or buzzer. Circuits can be illustrated by using symbols to show the flow of energy.

- The *wire* (—) conducts the electric *current* (the flow of electricity).
- The *switch* ( ) completes the circuit and allows current to flow if closed and stops the current if open.
- The *battery* ( ) pushes the electric current around the circuit.
- The *light bulb* ( ) is the object in the circuit that changes electrical energy to light energy.

It is essential for students to describe and make models of the path of the electric current in a *simple circuit*. In a *simple circuit*, the electric current goes through each component in the circuit in one complete sequential path from the source of the current.

- A diagram of a *simple circuit* has one path for the electric current to flow through and has symbols for a battery, a wire, a switch, and a device that changes electrical energy to another form of energy.

Extended Knowledge

- In a parallel circuit, the electric current branches into several loops and has more than one path through which the electric current flows. Each path contains at least one device (for example a light bulb) that changes electrical energy to another form of energy.
- If one bulb in a parallel circuit goes out, the current continues to flow through the other branches of the circuit and the other bulbs stay lit.

Science and Engineering Practices

S.1.A.2

Standard

3.P.3 The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

Conceptual Understanding
3.P.3A Energy can be transferred from place to place by electric currents. Electric currents flowing through a simple circuit can be used to produce motion, sound, heat, or light. Some materials allow electricity to flow through a circuit and some do not.

Performance Indicator
3.P.3A.3 Analyze and interpret data from observations and investigations to classify different materials as either an insulator or conductor of electricity.

Assessment Guidance
The objective of the indicator is to *analyze and interpret data* from observations and investigations to classify different materials as either an insulator or conductor of electricity. Therefore the primary focus of assessment should be for students to analyze and interpret data from observations, measurements, or investigations to understand that electric energy can be transferred throughout a circuit. This can include, but is not limited to students interpreting a diagram or planning an investigation to determine if an object in a circuit is used as an insulator or a conductor.

In addition to *analyzing and interpreting data* to classify insulators and conductors, students should *ask questions and plan and carry out investigations; use mathematical and computational thinking; engage in argument from evidence and construct explanations; develop and use models and obtain, evaluate, and communicate information;* and *construct devices or design solutions.*

Previous and Future Knowledge
- 6.P.3, 7.P.2 Conductors and Insulators

Essential Knowledge
It is essential for students to analyze and interpret data demonstrating that electric energy can be transferred from place to place in a circuit. Some materials allow electricity to move through them easily, while others do not.

Conductors of Electricity
- Conductors of electricity facilitate, or *conduct*, the transfer of electric energy.
- Conductors of electricity are made of materials in which the electrons can move freely and allow the flow of electricity.
- Materials that allow electricity to move easily through them and from one object to another through direct contact are called *conductors.*
- Metal objects are good *conductors* of electricity because electricity can transfer easily through the metal. For example, a metal wire will allow electricity to move easily through a circuit.

Insulators of Electricity
- Insulators of electricity inhibit, or *insulate*, the transfer of electric energy.
- Insulators of electricity are made of materials in which electrons are not free to move and thus impede the flow of electricity. Materials that do not allow electricity to move easily through them or from one object to another through direct contact are called *insulators*.
- Wooden and plastic objects are good *insulators* of electric energy because electricity does not move easily through wood or plastic. For example, a wooden craft stick or plastic spoon does not allow

electricity to move through a circuit.

NOTE TO TEACHER: This may be an opportunity for students to collect, organize, classify, and interpret data with multiple categories.

Extended Knowledge

- Students do not need to examine the conductibility of different metals.

Science and Engineering Practices

S. 1.A.4

Standard

3.P.3 The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

Conceptual Understanding

3.P.3B: Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An electromagnet is produced when an electrical current passes through a coil of insulated wire wrapped around an iron core. Magnets and electromagnets have unique properties

Performance Indicator

3.P.3B.1: Develop and use models to describe and compare the properties of magnets and electromagnets (including polarity, attraction, repulsion, and strength).

Assessment Guidance

The objective of the indicator is to *develop and use models* to describe and compare the properties of magnets and electromagnets. Therefore the primary focus of the assessment should be for students to construct 2-D drawings/diagrams or 3-D models that represent or use simulations demonstrating that a *magnet* is an object that produces a magnetic field. A magnetic field is an invisible force commonly experienced as attraction and repulsion. This could include, but is not limited to students using magnets to investigate attraction and repulsion and evaluate magnetic strength by counting the number of paper clips that a magnet/electromagnet can pick up.

In addition to *developing and using models*, students should *ask questions and plan and carry out investigations; use mathematical and computational thinking; engage in arguments from evidence; obtain, and communicate information;* and *construct devices or design solutions*.

Previous and Future Knowledge

- 2.P.3, 7.P.2 Properties of Magnets
- 5.P.5, 6.P.3 Magnetism

Essential Knowledge

It is essential for students to develop and use models demonstrating that a ***magnet*** is an object that produces a magnetic field. This magnetic field is an invisible force commonly experienced as attraction and repulsion.

Magnets can exert forces on other magnets or certain materials that are magnetized. This causes an energy transfer between the objects, even when they are not touching. An electromagnet is produced when an

Click HERE to return to the Table of Contents

electrical current passes through a coil of wire wrapped around any core that can be magnetized. Magnets and electromagnets have unique properties.

An *electromagnet* is a magnet created by wrapping a conductive wire around an iron core. When an electrical current is running through the wire, the magnetic core produces a magnetic field. The magnetic field goes away when the electrical current is turned off. For example, a copper wire wrapped around an iron nail and attached to a battery is a simple electromagnet.

The properties of magnets and electromagnets can be summarized as follows:

Polarity

- Magnets and electromagnets have areas called *poles*.
    - If the magnet is a bar or horseshoe magnet, the poles are on the ends. If the magnet is a donut magnet, the poles are on the top and bottom.
    - The magnetic pull or attraction is strongest at these poles. Every magnet has a *North* pole and a *South* pole.

The poles of magnets affect each other in the following ways:

Like poles

- Like poles repel, or move away from each other. For example, if the North Pole of one magnet and the North Pole of another magnet are brought close to each other, they will repel. The same thing happens if the South Pole of one magnet and the South Pole of another magnet are brought close to each other.

Unlike poles

- Unlike poles attract each other. If the North Pole of one magnet and the South Pole of another magnet are brought close to each other, they will attract.

Attraction

- Magnets and electromagnets *attract* each other when unlike poles are near each other.
- Magnets attract certain types of metals, such as iron, nickel and steel.
- When iron nails or steel paper clips are held near a magnet, they will move toward, or be attracted to, the magnet.

Repulsion

- Magnets and electromagnets can *repel* each other if their like poles (North-North or South-South) are brought near each other.

Strength

- The *strength* of a magnet or electromagnet is how strong of an attracting repelling force the magnet exerts on objects around it.
- The attractive *strength* of a magnet or electromagnet is greatest at its poles.
- Some magnets have a greater *strength* than other magnets.
- The *strength* of a magnet or electromagnet can be measured and compared by counting the number of objects, for example paper clips the magnet can pick up.

Extended Knowledge

- The magnetic field is made up of lines of force, or domains, which are invisible, tiny forces at work inside the magnet.
- The magnetic field exits the North Pole of a magnet and enters the magnet's South Pole.
- Students can use different types of visuals (iron filings) to see the flow of the magnetic field.

Science and Engineering Practices
S.1.A.2

Standard
3.P.3 The student will demonstrate an understanding of how electricity transfers energy and how magnetism can result from electricity.

Conceptual Understanding
3.P.3B: Magnets can exert forces on other magnets or magnetizable materials causing energy transfer between them, even when the objects are not touching. An electromagnet is produced when an electrical current passes through a coil of wire wrapped around an iron core. Magnets and electromagnets have unique properties.

Performance Indicator
3.P.3B.2: Plan and conduct scientific investigations to determine the factors that affect the strength of an electromagnet.

Assessment Guidance
The objective of the indicator is to *plan and conduct scientific investigations* to determine the factors that affect the strength of an electromagnet. Therefore, the primary focus of the assessment should be for students to plan and conduct scientific investigations to answer questions, test predictions and develop explanations to determine the factors that affect the strength of an electromagnet. Students should formulate scientific questions and predict possible outcomes; identify materials, procedures, and variables; select and use appropriate tools or instruments to collect qualitative and quantitative data, and record and represent data in an appropriate form while using appropriate safety procedures. This could include, but is not limited to students investigating with various numbers of coils, batteries with more voltage, and other properties such as increasing the diameter, length, or both of the iron core to determine factors that affect the electromagnet's strength and creating a graph to display their data.

In addition, to *plan and conduct scientific investigations*, students should *ask questions; use mathematical and computational thinking; engage in argument from evidence and construct explanations; develop and use models and obtain, evaluate , and communicate information;* and *construct devices or design solutions*.

Previous and Future Knowledge
- 6.P.3 Electromagnets

Essential Knowledge
Magnets can exert forces on other magnets, or other materials which can be magnetized. This causes an energy transfer between the objects, even when they are not touching. An electromagnet is produced when an electrical current passes through a coil of insulated wire wrapped around any core that can be magnetized. Magnets and electromagnets have unique properties.
Running a greater electrical current through an electromagnet creates a stronger electromagnet. The following physical properties allow a greater electrical current to run through the electromagnet:
Properties of the wire

- By increasing the number of coils of insulated conductive wire around a magnetic core (such as an iron nail), the strength of the electromagnet can be increased.

Click HERE to return to the Table of Contents

- By increasing the thickness of the conductive wire used, the strength of the electromagnet can be increased.

Number/voltage of batteries

- By using a battery with a greater voltage, the strength of the electromagnet can be increased.
- By adding more batteries (in series) to the electrical circuit, the strength of the electromagnet can be increased.

Properties of the core

- Changing the composition of the core will alter the strength of the electromagnet.
    - For example, an electromagnet with an iron core will have a greater magnetic strength than an electromagnet with a nickel core of the same size.

By increasing the diameter of the core he strength of the electromagnet can be increased.

Extended Knowledge

- Some of the strongest electromagnets created use gases as a core.
- Generators may be used to power an electromagnet rather than batteries.
- The electrical current running through the core causes lines of force, or domains, within the core which are usually going in various directions to all go in the same direction, which then produces a magnetic field.

Science and Engineering Practices
S.1.A.3

Standard
3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4A. Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities

Performance Indicator
3.E.4A.1 Analyze and interpret data from observations and measurements to describe and compare different Earth materials (including rocks, minerals, and soil) and classify each type of material based on its distinct physical properties

Assessment Guidance
The objective of this indicator is to *analyze and interpret data* to describe and compare different Earth materials (including rocks, minerals, and soil) and classify each type of material based on its distinct physical properties. Therefore, the primary focus of assessment should be for students to analyze and interpret data from observations of the three classifications of rocks – igneous, sedimentary, and metamorphic – and understand that rocks can be classified by properties, such as how they are formed, color, visible crystals or minerals, grain pieces, or patterns in the rock, such as stripes. Students also need to know the soil types, such as humus, clay, sand, and silt as well as how minerals are characterized by hardness, color, and luster. This could include but, is not limited to students observing different types of rocks, minerals, and soil, and comparing and contrasting them with an identification key.

In addition to *analyzing and interpreting data,* students should *ask questions; develop and use models; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; obtain, evaluate, and communicate information; construct devices or design solutions.*

Previous and Future Knowledge

- 1.E.4, 8.E.5, H.E.3 Earth material

Essential Knowledge

Students should know that there are three classifications of rocks – igneous, sedimentary, and metamorphic. Rocks can be classified by properties, such as how they are formed, color, visible crystals or minerals, grain pieces, or by patterns.

Igneous

- Igneous rock was once melted, but it has cooled and hardened.
- The melted material is called *magma* or *lava*.
- Igneous rocks may be glassy or grainy with crystals of different types of minerals in them.
- Granite is an example of an igneous rock.

Sedimentary

- Sedimentary rocks are usually made up of pieces of rock called *sediments* that have been pressed and cemented together.
- Some may contain pieces of animal shells, skeletons, remains of plants or animals.
- Sandstone and limestone are examples of sedimentary rocks.

Metamorphic

- Metamorphic rock was once another type of rock deep inside Earth, but heat and the pressing of the rocks above caused the minerals to change.
- Rocks that were pressed down could have the minerals line up in rows or bands.
- Sometimes the heat just changes the size of the mineral crystals.
- Marble and slate are examples of metamorphic rocks.

Humus

- Humus is soil that is made up of decayed parts of once-living organisms.
- It is dark, soft, and very crumbly.

Sand

- Sand has large grains with large spaces between the grains.
- This lets water leave it quickly.
- Sand feels gritty.

Clay

- Clay has very small grains, much smaller than sand or silt, and holds water easily.
- This makes clay sticky when wet, but when it dries, it forms hard clumps.

Silt

- Silt has pieces that are smaller than sand. It feels like powder.

Some soils are combinations of these soil types. For example, "*loam*" soil has large and small grains with lots of humus. This makes it dark and rich soil for plants. Another example, "*potting soil*" or "*topsoil*"; also has a lot of humus. Once some sand has been added to it, it is also good for growing plants.

Click HERE to return to the Table of Contents

Students need to know that *minerals* are solid, formed in nature, have never been alive, and have properties by which they can be identified. Some examples of physical properties of minerals may be:

- Color can be used along with other properties to help identify a mineral.
- Since many minerals have the same color, it cannot be used as the only property for identification.

Luster

- Some minerals can be very shiny, pearly, or glassy and other minerals are dull.

Special Properties

- If an acid (vinegar) is placed on a mineral, it may bubble or fizz.
- Some minerals split into thin sheets. Some minerals have magnetic properties.
-

A *mineral identification key* is a chart that will give information about the properties of the minerals listed on the key. Properties of a given mineral are compared to those listed on the key and the mineral can be identified. Some common minerals with very observable properties might include calcite, feldspar, mica, talc, gypsum, quartz, and fluorite. A sample mineral identification key is provided.

Mineral	**Properties**			
	Hardness (scratch test)	***Color***	***Luster***	***Special Properties***
Calcite	3 Scratched by nail	White	Dull/Glassy	Bubbles with acid
Feldspar	6 Scratches glass	Pink or white	Dull/Pearly	---
Mica	2 Scratched by fingernail	Black/Gray	Shiny	Splits into thin sheets
Talc	1 Easily scratched by fingernail	White	Dull	---
Gypsum	2 Scratched by fingernail	White/Gray	Dull	---
Quartz	7 Scratches glass	Various colors	Glassy	
Fluorite	4	Various colors		

Hardness

- Hardness refers to whether the mineral can be scratched or can scratch something else.
- The harder a mineral, the fewer things can scratch it.
- The hardness is measured 1-10 with 1 being the softest and 10 being the hardest.

Diamond is the hardest mineral.

Color

- Color can be used along with other properties to help identify a mineral.
- Since many minerals have the same color, it cannot be used as the only property for identification.

Luster

- Some minerals can be very shiny, pearly, or glassy and other minerals are dull.

Click HERE to return to the Table of Contents

Special Properties
• If an acid (vinegar) is placed on a mineral, it may bubble or fizz.
• Some minerals split into thin sheets. Some minerals have magnetic proper

A mineral identification key is a chart that will give information about the properties of the minerals listed on the key. Properties of a given mineral are compared to those listed on the key and the mineral can be identified. Some common minerals with very observable properties might include calcite, feldspar, mica, talc, gypsum, quartz, and fluorite. A sample mineral identification key is provided.

NOTE TO TEACHER: This may be an opportunity for students to collect, organize, classify, and interpret data with multiple categories.

Extended Knowledge

- Classifications within each type of rock.
- The relationship between the groups of rocks as explained by the rock cycle.
- Compare and contrast soil types based on grain size.
- Explain the relationships between the types of rocks in the rock
- Soil layers, properties and conservation
- Crystal shape of minerals
- Breakage properties of minerals
- Mohs scale of hardness

The streak color of a mineral formed when the mineral is scratched across a ceramic plate.

Science and Engineering Practices
S.1.A.4

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4A: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.

Performance Indicator
3.E.4A.2 Develop and use models to describe and classify the pattern distribution of land and water features on Earth.

Assessment Guidance
The objective of this indicator is to *develop and use models* to describe and classify the pattern distribution of land and water features on Earth. Therefore, the primary focus of assessment should be for students to develop a model to understand or represent phenomenon of various water features such as oceans, seas, rivers, streams, lakes, ponds, and glacier. Furthermore, describe and classify each based on individual characteristics. This could include, but is not limited to students classifying and describing the different bodies of water from various pictures of water features.

In addition to *developing and using models*, students should *ask questions; analyze and interpret data; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; obtain, evaluate, and communicate information; construct devices or design solutions.*

Previous and Future Knowledge
- 5.E.3, 8.E.5 Land features
- 5.E.3, H.E.6 Water features

Essential Knowledge
It is essential for students to know that there are many places on Earth where water (salt or fresh) is found. Most of the water on Earth is saltwater. Water is mostly in liquid form in these features, but sometimes it can be solid (ice). Earth's water features include:
Oceans
- Oceans are large bodies of salt water that surround a continent.

Seas
- Seas are large bodies of salt water that is often connected to an ocean.
- A sea may be partly or completely surrounded by land.

Rivers
- Rivers are large, flowing bodies of fresh water that usually empty into a sea or ocean.

Streams
- Streams are small, flowing bodies of fresh water that flow into rivers.

Lakes& ponds
- Lakes and ponds are areas where water, usually freshwater, are surrounded by land.
- Lakes and ponds differ in size with ponds usually being smaller than lakes.

Glaciers
- Glaciers are huge sheets of ice that cover land.
- They are found where temperatures are very cold, for example, high in the mountains or near the poles of Earth.

Students should know how to create detailed models of land features and bodies of water, and that certain land and water features are specific to different locations on Earth.

Note: This standard now includes glaciers, which was not previously taught.

Extended Knowledge
- Name specific bodies of water, and identify them visually
- Explain the characteristics of environments that include rivers and streams.
- Compare ecosystems that include oceans, lakes, and ponds.

Science and Engineering Practices
S.1.A.2

Standard
3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4A.: Earth is made of materials (including rocks, minerals, soil, and water) that have distinct properties. These materials provide resources for human activities.

Performance Indicator
3.E.4A.3 Obtain and communicate information to exemplify how humans obtain, use, and protect renewable and nonrenewable Earth resources.

Assessment Guidance
The objective of this indicator is *to obtain and communicate information* to exemplify how humans obtain, use, and protect renewable and nonrenewable resources on Earth. Therefore, the primary focus of assessment should be for students to obtain and evaluate informational texts, observations, and data collected to generate and answer questions and understand phenomenon that distinguish between renewable and nonrenewable resources. Students should also describe how humans obtain, use, and protect these resources. This includes, but is not limited to, students identifying that fuels, building structures, and growing plants are either renewable or nonrenewable and communicating various ways that humans can use and protect these activities.

In addition to *obtaining and communicating information*, students should *ask questions; analyze and interpret data; develop and use models; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; construct devices or design solutions.*

Previous and Future Knowledge
- 5.E.3, 8.E.5, H.E.3 Renewable and nonrenewable resources

Essential Knowledge
It is essential for students to know that Earth is rich in useful resources that can be used for various purposes:

Fuels
Earth materials come from inside Earth and are used as fuels. For example, fuels such as oil and coal can be burned to produce heat or made into gasoline to help run cars and other vehicles.

Building structures
Earth materials can be mined from Earth and used to make building blocks or other building materials. For example, granite, marble, and sandstone have been used to make blocks for homes and office buildings.

Growing plants
Earth materials are used for growing plants. For example, soil is made up of weathered pieces of rocks, minerals, and humus, which supply water, nutrients and support for growing plants. Different types of soil are needed depending upon the type of plants that need to grow in the soil. Climate can also affect type and growth of plants.

Click HERE to return to the Table of Contents

Note: Renewable resources are those that can be replenished. Some examples include: sun, wind, replanting trees, etc. Nonrenewable resources are those that cannot be replenished and will eventually disappear. Some examples include: fossil fuels, coal, oil, and natural gas.

Extended Knowledge

- Runoff across Earth's surface as part of the water cycle.
- Geology of why a landslide, a volcanic eruption, or earthquake occurs
- Conservation of natural resources.
- Importance of fossil fuels as Earth resources.

Science and Engineering Practices
S.1.A.8

Standard 3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4B: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

Performance Indicator
3.E.4B.1 Develop and use models to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, plains, and islands.

Assessment Guidance
The objective of this indicator is to *develop and use models* to describe the characteristics of Earth's continental landforms and classify landforms as volcanoes, mountains, valleys, canyons, plains, and islands. Therefore, the primary focus of assessment should be for students to develop a model or a picture to understand or represent the phenomenon of different landforms and describe and classify each based on its characteristics. This could include, but is not limited to students classifying and describing the different types of landforms from various pictures or drawing pictures with labels in a science journal.

In addition to *developing and using models*, students should *ask questions; analyze and interpret data; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; obtain, evaluate, and communicate information; construct devices or design solutions.*

Previous and Future Knowledge

- 5.E.3, 8.E.5, H.E.3 Landforms

Essential Knowledge
It is essential for students to know that Earth's surface has many natural shapes or features called *landforms*. Earth's land features that can be seen on models, pictures, diagrams, and maps include:
Volcanoes

- An opening in Earth's surface from which lava flows.

- As the lava hardens and builds up, a *volcanic mountain* forms.

Mountains

- A place on Earth's surface where the land is much higher than the land that surrounds it.
- Some mountains are tall and rocky, while others are rounded and covered with trees.
- A mountain area that has a flat top is called a *plateau*.

Valleys

- A lowland area between higher areas such as mountains.
- Sometimes rivers can wear away land to form valleys.

Canyons

- A deep valley with very steep sides.
- They are often carved from the Earth by a river.

Plains

- A flat region of lowlands. Occurs at the bottoms of valleys.

Islands

- An area of land that is entirely surrounded by water.
- Sometimes islands are located in lakes, or they may be out from the seashore as barrier islands.

Extended Knowledge

- Name specific landforms
- Compare continental and oceanic landforms
- Illustrate the creation and changing of landforms including volcanic eruptions and mountain-building.

Science and Engineering Practices

S.1.A.2

Standard

3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding

3.E.4B: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

Performance Indicator

3.E.4B.2 Plan and conduct scientific investigations to determine how natural processes (including weathering, erosion, and gravity) shape Earth's surface.

Assessment Guidance

The objective of this indicator is *to plan and conduct* scientific investigations to determine how natural processes, such as weathering, erosion, and gravity shape Earth's surface. Therefore, the primary focus of assessment should be for students to plan and conduct an investigation to answer questions, test predictions, and develop explanations. Students then should identify, record and represent data in an appropriate form of how slow processes (weathering, erosion, and deposition) and how rapid processes (landslides, volcanic eruptions, floods, and earthquakes) affect Earth's surface. This could include, but is not limited to students creating a step-by step investigation of how these different processes affect and shape the makeup of the land, using a model of Earth's surface.

In addition to *planning and conducting investigations*, students should *ask questions; analyze and interpret data; develop and use models; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; obtain, evaluate, and communicate information; construct devices or design solutions.*

Previous/Future Knowledge

- 5.E.3, 8.E.5, H.E.3 Weathering and erosion
- 4.E.3, 8.E.4 Gravity

Essential Knowledge

It is essential for students to *plan and conduct* scientific experiments. They will also need to know the definition of gravity for this standard. Gravity can cause rocks and boulders to fall down hills and mountains, and causes water to flow downhill. It is also essential for students to know that the surface of Earth does change in natural ways. Sometimes the change can be caused by a very slow process, and at other times it can be caused by a rapid process. There is often evidence on the surface that these processes have caused a change.

Changes Due to Slow Processes

Weathering

When weathering is occurring, Earth materials, like rocks, are being broken apart. Cracks in the rock are evidence that weathering is taking place.

Erosion

When erosion is occurring, Earth materials, like rock, sand, and soil, are being carried away from their original location. Water and wind are often the causes for erosion.

Deposition

When deposition is occurring, Earth materials that have been eroded are put in a new location. When the wind stops blowing, sand and soil may be put down in piles as large as dunes. Water may deposit its material at the end of a river and form a delta.

Changes Due to Rapid Processes

Landslides

When a landslide is occurring, Earth materials, like rock, sand, and soil, on the side of a slope or cliff drop down to a lower location. Water soaking into the ground often makes this happen.

Volcanic Eruptions

When a volcanic eruption is occurring, Earth material called *lava* comes out of the volcano, and flows down the side of the volcanic mountain, or is sent up into the air and lands nearby, where it hardens. The hardened volcanic rock forms new Earth material, and often makes the volcanic mountain larger.

Floods

When a flood is occurring, a lot of water causes rivers and streams to overflow their banks over the surrounding land around them. Heavy rainfall in the area is usually the cause of a flood.

Earthquakes

When an earthquake is occurring, the surface of the ground shakes and rolls causing damage to the Earth's surface, like cracks and other openings, and damage to roads and buildings.

Extended Knowledge

- Runoff across Earth's surface is a part of the water cycle.
- Geology of why a landslide, a volcanic eruption, or earthquake occurs.

- How the natural processes affect the land and oceans in constructive and destructive ways.

Science and Engineering Practices
S.1.A.3

Standard
3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4B: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

Performance Indicator
3.E.4B.3 Obtain and communicate information to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment.

Assessment Guidance
The objective of this indicator is *to obtain and communicate information* to explain how natural events (such as fires, landslides, earthquakes, volcanic eruptions, or floods) and human activities (such as farming, mining, or building) impact the environment. Therefore, the primary focus of assessment should be for students to obtain and evaluate informational texts, observations, or discussions to distinguish between the types of events and communicate how each event affects the environment. This could include, but is not limited to students using books, articles, and websites to find information about natural events and human activities, then communicating its impact on the environment through tables, drawings, or posters.

In addition to *obtaining and communicating information*, students should *ask questions; analyze and interpret data; develop and use models; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; construct devices or design solutions.*

Previous and Future Knowledge
- 5.E.3, 8.E.6, H.E.5 Natural events
- 5.E.3, H.E.3, H.E.5 Human activities

Essential Knowledge
Students must demonstrate knowledge of cause and effect in terms of damaging the Earth's surface from various events such as the ones listed below.

Landslides
When a landslide is occurring, Earth materials, like rock, sand, and soil, on the side of a slope or cliff drop down to a lower location. Water soaking into the ground often makes this happen.

Volcanic Eruptions
When a volcanic eruption is occurring, Earth material called *lava* comes out of the volcano, and flows down the side of the volcanic mountain (or is sent up into the air and lands nearby) where it hardens. The hardened volcanic rock forms new Earth material and often makes the volcanic mountain larger.

Floods
When a flood is occurring, a lot of water causes rivers and streams to overflow their banks over the surrounding land around them. Heavy rainfall in the area is usually the cause of a flood.

Earthquakes
When an earthquake is occurring, the surface of the ground shakes and rolls causing damage to the Earth's surface such as cracks, damage to roads and buildings.

Extended Knowledge

- Geology of why a landslide, a volcanic eruption, or earthquake occurs.
- Ways to reduce and prevent the impact on the environment.
- Ways to replenish the environment after these events. An example is planting trees after a forest fire.

Science and Engineering Practices
S.1.A.8

Standard
3.E.4: The student will demonstrate an understanding of the composition of Earth and the processes that shape features of Earth's surface.

Conceptual Understanding
3.E.4B: Earth's surface has changed over time by natural processes and by human activities. Humans can take steps to reduce the impact of these changes.

Performance Indicator
3.E.4B.4 Define problems caused by a natural event or human activity and design devices or solutions to reduce the impact on the environment

Assessment Guidance
The objective of this indicator is *to define problems* caused by a natural event or human activity and *construct devices or solutions* to reduce the impact on the environment. Therefore, the primary focus of assessment should be for students to construct devices or design solutions to solve specific problems or needs: ask questions to identify problems, ask questions about the criteria and constraints of the devices, generate and communicate ideas for possible devices or solutions, build and test devices or solutions. Students then determine if the devices or solutions solved the problem and refine the design if needed and communicate the results that distinguish between the two types of events and reduce impact on the environment. This could include, but is not limited to students identifying that an earthquake is a natural event and design a building structure that would possibly withstand its effects.

In addition to *constructing devices or solutions*, students should *ask questions; analyze and interpret data; develop and use models; plan and carryout investigations; use mathematical and computational thinking; engage in scientific argument from evidence; construct explanations; obtain, evaluate, and communicate information.*

Previous and Future Knowledge

- 5.E.3, H.E.3, H.E.5 Human activity

- 5.E.3, 8.E.5, H.E.3, H.E.5, H.E.6 Environment

Essential Knowledge
Students need to recall problems caused by natural events or human activity, and distinguish between the two types. They must interpret events to find and construct possible solutions.

Extended Knowledge
- Causes of natural disasters and future human activity.
- Geology of why a landslide, a volcanic eruption, or earthquake occurs.

Science and Engineering Practices
S.1.B.1

Standard
3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

Conceptual Understanding
3.L.5A The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets energy.

Performance Indicator
3.L.5A.1 Analyze and interpret data about the characteristics of environments (including salt and fresh water, deserts, grasslands, forests, rain forests, and polar lands) to describe how the environment supports a variety of organisms.

Assessment Guidance
The objective of this indicator is to *analyze and interpret data* about characteristics of environments that support different organisms. Therefore, the primary focus of assessment should be to analyze and interpret data from observations, measurements, or investigations to describe how different organisms are able to survive in different environments where their needs are met. This could include, but is not limited to students collecting data from a variety of environments related to environmental characteristics, such as light, temperature, water, soil, and space. Students will utilize the collected data to decide if the basic needs of organisms are met in a specific environment.

In addition to *analyzing and interpreting data,* students should *ask questions; plan and carry out investigations; use mathematics and computational thinking; engage in argument from evidence; construct explanations; develop and use models; obtain, evaluate, and communicate information*; and *construct devices or design solutions.*

Previous and Future Knowledge
- K.L.2A.5 Basic needs of organisms
- 2.L.5B.2 Characteristics of animals for distinct environments

Essential Knowledge
Organisms survive best in certain environments in which the appropriate amounts of physical factors (light, temperature, water, soil, and space for shelter and reproduction) are present. Each environment has a unique combination of these factors that allows certain organisms to survive there.

Examples of environments include:

Salt Water:
Oceans are large bodies of salt water divided by continents. Since ocean water is constantly moving, the characteristics of the water are constantly changing. The amount of sunlight varies by depth, hence temperature also varies by depth. The amount of salt, other minerals and additives also varies based on what lives within the water and sometimes what pollution has been placed in the water.

- Most organisms live in the shallow portion of the ocean because sunlight can penetrate to keep the water warm, and food is abundant. Some examples of organisms that live in the shallow parts of the ocean are drifters (jellyfish or seaweed), swimmers (fish), crawlers (crabs), and those anchored to the sea floor (corals).
- Some organisms live in the open ocean, near the surface of the ocean, or in the deep ocean bottom. Plankton float in the upper regions of the water. Some organisms swim to the surface for food or air (whales, turtles, dolphins) while other organisms stay closer to the bottom of the ocean (octopus).
-

Estuaries:
Estuaries are found where freshwater rivers and salt water meets. Estuaries are saltier than a river, but not as salty as the ocean. The amount of salt (salinity) changes with the tides. Estuaries contain *salt marshes* with grasses and marsh plants adapted to this changing water. Examples of animals that live in the estuaries/salt marshes include crabs, shrimp, birds (i.e. blue heron and egrets), and muskrats.

Fresh Water:

- Lakes and ponds are bodies of freshwater that are surrounded by land. Ponds are usually shallower than lakes and the temperature of the water usually stays the same from top to bottom. Plants and algae usually grow along the edges where the water is shallow. Examples of animals that live in fresh water include fish, amphibians, ducks, turtles, or beavers.
- Rivers and streams are moving bodies of water that can be found in warm or cold areas.
- The water in rivers and streams can be fast or slow moving.
  - The speed of the water flow determines the types of plants and animals that live in or use the rivers and streams.
  - There are many plants (bushes and trees) along the banks as well as plants growing in the water.
  - Many animals (i.e. fish, crayfish, snakes, worms, and insects) use these plants for food or shelter.
- Swamps are located in areas with warm temperatures.
  - Since swamps have thick plant growth such as ferns and reeds, small bushes and small trees do not thrive due to lack of sunlight.
  - The surviving trees are very tall, reaching for sunlight. Standing water causes the trunks of the trees to spread out to provide support.
  - For example the cypress, a tree found in the swamp has “knees,” or roots that come to the surface for oxygen.
  - The animals that live in the swamp are very adapted to a water environment (i.e. alligators, turtles, ducks, and egrets).

Deserts:

  - Are dry with extreme temperature ranges.

- Some deserts are covered with sand.
- In some deserts during the day, it is very hot, whereas the nights are very cold.
- Most of the plants (i.e. cacti) and animals (i.e. lizards, scorpions, and rabbits) have ways to conserve moisture; are able to go long periods without water; or can withstand the extreme temperature changes.
- Most of the animals are active during the night when temperatures are cooler.

Grasslands:

- Have fertile soil and are covered with tall grasses.
- They usually get a moderate amount of rain, but less than forests.
- Temperatures may also vary depending on where the grassland is located.
- Some examples of animals that live in the grasslands are prairie dogs, bison, and grasshoppers.

Forests:

- Have many trees (with needles or with leaves), shrubs, grasses and ferns, and a variety of animals.
- They usually get more rain than grasslands.
- Temperatures in the forests may vary depending on where the forest is located.

Rainforests:

- Are very humid and warm and have an abundance of rain that leads to lush plant growth (for example, tall trees, vines, ferns, orchids, and other colorful flowering plants).
- Animals that live in the rainforest are often very colorful, to match the varieties of plants (for camouflage)
- Many animals are also tree dwellers (i.e. birds and lizards), moving across the canopy rather than traveling on the ground.

Polar Lands:

- Are usually very cold and the amount of daylight varies throughout the year.
- Winters are mostly dark with only moonlight and starlight, whereas in the summers, there is up to 24 hours of daylight. There is little variety of plant life (mosses, for example).
- Animals that live in the polar region (for example, reindeer, seals, polar bears, arctic foxes, and penguins) are adapted to these conditions by having extra fat or thick fur for insulation.

Summary of Characteristics of Distinct Environments

	Temperature	Water	Light	Plant Life (examples)	Animal Life (examples)
Oceans	cold to warm (depending on location)	extremely salty	lots of light near the surface, less light at depth	plankton	whales, turtles, sharks, jellyfish, crabs
Estuaries/Salt Marsh	cold to warm (depending on location)	brackish (partially salty)	abundant light on land surfaces; light is filtered through water	cordgrass, trees, shrubs	crabs, shrimp, water birds, deer, snails
Lakes and Ponds	cold to warm (depending on location)	freshwater	lots of light near the surface, less light at depth	algae, shallow water grasses	fish, amphibians, ducks, turtles, beavers
Rivers and Streams	cold to warm (depending on location)	freshwater	abundant light on land surfaces; light is filtered through water	bushes, trees on banks, water plants	fish, crayfish, snakes, insects
Swamps	warm-hot	freshwater	light is filtered through trees to the swamp floor	cypress trees, ferns, water lilies	alligators, water birds, turtles
Deserts	hot and dry during the day, cold at night	dry, water in the form of occasional brief rainfall	abundant light	cactus	lizards, scorpions, rabbits
Grasslands	cool to warm (depending on location)	medium amount of rain	abundant light	grasses	prairie dogs, bison, grasshoppers
Forest	cold to warm (depending on location)	medium amount of rain	abundant light on tree canopy; less light is filtered to the forest floor through the trees	trees with leaves or needles, shrubs, grasses, ferns	birds, foxes, rabbits, bears, snakes, deer
Tropical Rainforest	hot and humid	frequent rain; large amounts	abundant light on tree canopy; less light is filtered to the forest floor through the trees	abundant trees, vines, lush growth	birds, frogs, monkeys, snakes
Polar lands	cold	dry/frozen	amount of daylight varies throughout the year	lichens, mosses	seals, polar bears, penguins

NOTE TO TEACHER: This may be an opportunity for students to collect, organize, classify, and interpret data with multiple categories.

Extended Knowledge
- Identify the different types of forests (coniferous, deciduous), specific ocean zones or specific locations of these environments on a map.
- Polar lands include the tundra, arctic, and Antarctic areas.

Science and Engineering Practices
S.1.A.4

Standard
3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

Conceptual Understanding
3.L.5A The characteristics of an environment (including physical characteristics, temperature, availability of resources, or the kinds and numbers of organisms present) influence the diversity of organisms that live there. Organisms can survive only in environments where their basic needs are met. All organisms need energy to live and grow. This energy is obtained from food. The role an organism serves in an ecosystem can be described by the way in which it gets energy.

Performance Indicator
3.L.5A.2 Develop and use a food chain model to classify organisms as producers, consumers, and decomposers and to describe how organisms obtain energy.

Assessment Guidance
The objective of this indicator is to *develop and use model* to classify organisms. Therefore, the primary focus of assessment should be to *develop and use models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others about* a food chain. This could include, but is not limited to students developing and using a food chain model to show how organisms obtain energy, as well as how energy flows through the food chain in order to classify organisms as producers, consumers, and decomposers.

In addition to *developing and using models*, students should *ask questions; plan and carry out investigations; analyze and interpret data; use mathematics and computational thinking; engage in argument from evidence; construct explanations; obtain, evaluate, and communicate information*; and *construct devices or design solutions.*

Previous and Future Knowledge
- 2.L.5B.1 Relationship between plants and animals

Essential Knowledge
All organisms need energy to survive. Energy gives the organism its ability to do the things it needs to do to survive. In most habitats, the sun provides the initial energy for the plants, which is passed from plants (producers) to animals (consumers) when animals eat the plants.

- When scientists describe the way energy is passed from one organism to another they use a model called a *food chain*.

A food chain uses arrows to show the direction of energy flow and usually contains no more than six organisms.

Extended Knowledge

- Knowledge of food webs
- Specific consumers (herbivores, carnivores, omnivores)

Science and Engineering Practices

S.1.A.2

Standard

3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

Conceptual Understanding

3.L.5B When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

Performance Indicator

3.L.5B.1 Obtain and communicate information to explain how changes in habitats (such as those that occur naturally or those caused by organisms) can be beneficial or harmful to the organisms that live there.

Assessment Guidance

The objective of this indicator is to *obtain and communicate information* to explain how changes in habitats can be beneficial or harmful to the organisms that live there. Therefore, the primary focus of assessment should be for students to obtain and evaluate informational texts, observations, data collected, or discussions to generate and answer questions. Students should also support explanations, claims, or designs about the benefits or harms to organisms that live in changing (or changed) habitats. This could include, but is not limited to students reading informational texts to gather information about the results of changing habitats.

In addition to *obtaining and communicating information*, students should to *ask questions; plan and carry out investigations; analyze and interpret data; use mathematics and computational thinking; engage in argument from evidence; construct explanations; develop and use models*; and *construct devices or design solutions.*

Previous and Future Knowledge

- 1.L.5B.3 Plant responses to environment
- 2.L.5B.3 Animal response to environment
- 4.L.5B.3 Adaptations of animals
- 5.L.4A.1, 5.L.4A2 Ecosystems

Essential Knowledge

Habitats change due to natural causes or actions of organisms. These changes may be helpful or harmful to the organisms that live there. ***All*** organisms change the environment in helpful, or harmful ways. Natural changes in the environment include floods, fires, droughts, landslides, volcanic eruptions, and earthquakes. Changes to an environment can also be caused by human carelessness, urbanization, pollutants, or the introduction of non-native species.

* The natural changes listed above are covered in Earth Science 3E.4B.3.

Actions of organisms	**Harmful effect**	**Beneficial effect**
humans pollute the air with emissions from vehicles and factories	organisms breathing unclean air may become sick or die	None
humans cut down trees to build homes	animals struggle to find trees and plants for food and shelter; there are less trees to clean the air	plants and animals that thrive in grassland areas have new areas for shelter and space
humans pollute the water with toxic chemicals and trash	drinking water for humans and animals is poor quality; plants and animals that live in the water are harmed	None
herd animals (cows, etc.) may overgraze the land	land with less or no grass can be easily eroded by wind and water; animals may pollute streams or lakes with their droppings	herd animals fertilize the land with their droppings which lead to new plant growth
humans dig mines in the ground or inside mountains	sinkholes can form, swallowing large areas of land; trees are logged to create areas for dumping debris from the mine; water can be polluted by chemical runoff from mines	Extract metals and minerals to build things; make jewelry; make medicines and materials, etc.
beavers create dams which block the flow of water	water does not reach plants or animals downstream who depend on it for survival	dams create pond environments in which new plants and animals can survive
due to lack of resources, animals migrate to new areas	there is more competition for space and food	None
Farmers/companies replanting fields with the same crop repeatedly	Long term harm – depleting soil of minerals	Short term benefit – provide food and/or resources

Natural occurrences	Harmful effect	Helpful effect
floods	destroy ecosystems on the land which cause animals to struggle to meet basic needs (food, shelter, space, etc.)	floods carry and deposit nutrients that enrich the soil so that new plants can grow
fires	destroy plants and trees which are sources of food and shelter	benefits plants by adding nutrients to the soil; removes dead and decaying plants; eliminates dense foliage, allowing seeds to grow and thrive; restores plant nutrients to the soil
droughts	plants and trees may die due to lack of water; organisms that rely on the plants and trees for food may die as a result	in wetlands/marshes, droughts allow these areas to begin to dry out, causing new plant growth
landslides	destroys habitats	makes uninhabitable environments more easily accessible; make new areas for plants and animals to grow
volcanic eruptions	destroy entire ecosystems including all plants and animals; make the air difficult to breathe nearby	volcanic ash contains nutrients that enrich the soil which will help new plants grow; volcanic rocks are often used as building materials
earthquakes	earthquakes can trigger landslides, which can destroy plant and animal habitats	can make natural resources easier to access

Extended Knowledge

- causes and effects of global warming
- acid rain
- biotic and abiotic factors
- limiting factors

Science and Engineering Practices
S.1.A.8

Standard
3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

Conceptual Understanding
3.L.5B When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

Performance Indicator
3.L.5B.2 Develop and use models to explain how changes in a habitat cause plants and animals to respond in different ways (such as hibernating, migrating, responding to light, death, or extinction).

Assessment Guidance
The objective of this indicator is to *develop and use models* to explain how changes in a habitat cause plants and animals to respond in different ways. Therefore, the primary focus of assessment should be for students to *develop and use models to (1) understand or represent phenomena, processes, and relationships, (2) test devices or solutions, or (3) communicate ideas to others* how changes in habitats cause organisms to respond in different ways. This could include but is not limited to students developing a model to illustrate the seasonal migration patterns of geese based upon research gathered from government wildlife tracking websites.

In addition to *developing and using models*, students should *ask questions; plan and carry out investigations; analyze and interpret data; use mathematics and computational thinking; engage in argument from evidence; construct explanations; obtain, evaluate, and communicate information*; and *construct devices or design solutions.*

Previous and Future Knowledge
- 1.L.5B.3 - Plant responses
- 2.L.5B.2 - Characteristics of animals for survival in distinct environments
- 2.L.5B.3 - Animal response to environment (eating behaviors, hibernation, migration)
- 4.L.5B.1 – Animals respond to signals from the environment
- 8.E.6B.2 – Extinction of a species

Essential Knowledge
Changes in habitats cause organisms to respond in different ways.
- Animals may respond to changes in habitats by migrating to new areas if their basic needs cannot be met in their existing habitat.
- Other animals (such as bears) may hibernate if they are unable to find sufficient food sources or if the temperature becomes too cold.
- More light is available for the forest floor when some trees are cut, allowing other plants to grow taller. Seeds may not germinate if there is insufficient rainfall or if the temperature is too cold.
- Both plants and animals may be unable to respond to changes in their habitat and may individually die or become extinct. *Extinction* is the death of an entire group of organisms. Extinction occurs if over many generations, animals or plants cannot adapt to changes in the environment.

Extended Knowledge
- Specific animal defenses
- Causes of natural occurrences
- Specific organisms that are extinct

* Specific examples of natural occurrences are explained in 3.E.4B.3.

Science and Engineering Practices
S.1.A.2

Standard
3.L.5 The student will demonstrate an understanding of how the characteristics and changes in environments and habitats affect the diversity of organisms.

Conceptual Understanding
3.L.5B When the environment or habitat changes, some plants and animals survive and reproduce, some move to new locations, and some die. Fossils can be used to infer characteristics of environments from long ago.

Performance Indicator
3.L.5B.3 Construct scientific arguments using evidence from fossils of plants and animals that lived long ago to infer the characteristics of early environments.

Assessment Guidance
The objective of this indicator is to *construct scientific arguments* of the characteristics of early environments using inferences based on evidence collected from fossils of plants and animals that lived long ago. Therefore, the primary focus of assessment should be to *construct explanations of phenomena using (1) scientific evidence and models, , (2) conclusions from scientific investigations, predictions based on observations and measurements, or (4) data communicated in graphs, tables, or diagrams* about early environments based on fossils of plants and animals. This could include but is not limited to students looking at fossils of seashells found in Columbia and constructing arguments to support a claim that the environment was once covered by an ocean.

In addition to *constructing scientific arguments from evidence*, students should *ask questions; plan and carry out investigations; analyze and interpret data; use mathematics and computational thinking; construct explanations; obtain, evaluate, and communicate information; develop and use models;* and *construct devices or design solutions.*

Previous and Future Knowledge
- 8.E.6A.4 – Fossils provide evidence

Essential Knowledge
A fossil is the remains of a living organism that lived long ago and has been preserved in rock or has hardened minerals. Fossils can give information about what the environment was like in the location where the fossil was found. For example,

- Fossils of a water organism found in an area that is now mountains means that area was possibly once under water.
- Fossils of crab burrows found on grasslands suggest that area was possibly once near an ocean.
- Fossils of trees or tree parts found in a desert mean that area was possibly once a forest.
- Fossils of plants found in very cold areas of Earth means that area at one time possibly had a warmer climate.

Every time a new fossil is found, more information about life on Earth and the environment of Earth is discovered. For example,

- Fossilized shark teeth prove that sharks in the past lived in an environment similar to current environments, because their teeth are similar.

- Skulls and lower jaws of crocodilians found in the sandy clay of the coastal plain suggest that these ancestors of modern day alligators and crocodiles lived in the shallow, warm waters of an estuary/salt marsh.
- The wide horns of the ancient buffalo that once roamed the land indicate that there were more grasslands in South Carolina.
- The long, sharp teeth on the skull of the saber-toothed cat fossil, found in rocky sand with other animal fossil, hints that the saber-toothed cat lived in a heavily populated forest.

Extended Knowledge
Some characteristics of animals are inherited from parents and some are influenced from the environment.

Science and Engineering Practices
S.1.A.7